Quality Assessment of Fetal Death Records in Georgia: A Method for Improvement

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ABSTRACT

Objectives. Although more fetal deaths than neonatal deaths occur, routinely collected fetal death data are seldom used for perinatal epidemiologic research because of data quality concerns. We developed a strategy for identifying and correcting errors in birthweight and gestational age in fetal death records.

Methods. Using data from Georgia for 1989 and 1990, we detected singleton fetal death records having improbable or missing birthweight or gestational age by comparing these values with referent values. To verify the questionable values, we contacted 100 reporting hospitals in 1992.

Results. In 817 of 2226 records, values were either improbable (60.1%) or missing (39.9%). We were able to contact the hospitals to verify data for 716 (88%) of these records. Verification resulted in corrections to 405 (57%) records, and 48% of unreported birthweights were obtained.

Conclusions. Many errors in recorded gestational age and birthweight were identified by this method. Rather than deleting or imputing problem data for analyses, researchers should consider efforts to verify them. Efforts to improve this information should include improved reporting, strict quality assurance, and procedures for routine verification and correction of records. (*Am J Public Health.* 1997;87:1323–1327)

Introduction

To properly evaluate adverse reproductive outcomes, analyses need to account for both fetal and infant deaths. Studies addressing perinatal losses have largely been limited to neonatal (<28 days old) or infant (<1 year old) deaths, but more fetal (≥20 weeks' gestation) than neonatal deaths occur.[1] Fewer fetal death prevention efforts have been initiated because of the limited understanding of risks related to fetal death and the poorer quality of fetal, compared with infant, mortality data.[2] Besides suffering an emotional loss, a woman who delivers a stillborn fetus is at risk for other adverse reproductive outcomes. Identifying preventable risk factors for fetal deaths could substantially contribute to identifying preventable risk factors for other adverse reproductive outcomes sharing similar risks,[3–7] such as preterm delivery.

Fetal death data are seldom used for perinatal research because of the concern about high error rates. Yet the quality of fetal death data has rarely been evaluated.[2] Certainly live-birth analyses are significantly affected by these errors.[8,9] But when problematic records are simply omitted from analyses, results can be biased, since these records may disproportionately represent women at greatest risk, for example, women who deliver pre- or postterm infants or infants with extreme birthweights.[10,11]

In this study, we propose a method to identify and correct data quality problems in fetal death records. We hypothesized that records were highly likely to have errors if both recorded birthweight and gestational age values fell outside referent values.

Georgia is one of eight states or territories in the United States that require reporting of fetal deaths regardless of gestational age, including spontaneous abortions (<20 weeks' gestation).[12] Using Georgia data, we developed a strategy to improve these data, estimated the magnitude of both missing and biologically improbable birthweights and gestational ages, and evaluated potential problem sources.

Methods

Our study had three main stages. First, we evaluated the population for improbable or missing values for gestational age and birthweight. Next, we selected the problem records, verified data or obtained missing data by contacting reporting hospitals, and made corrections. Third, we examined potential problem data sources and checked the effects of corrections. We used computerized databases of reported fetal deaths in Georgia from 1989 through 1990. We excluded 3976 records lacking information on the

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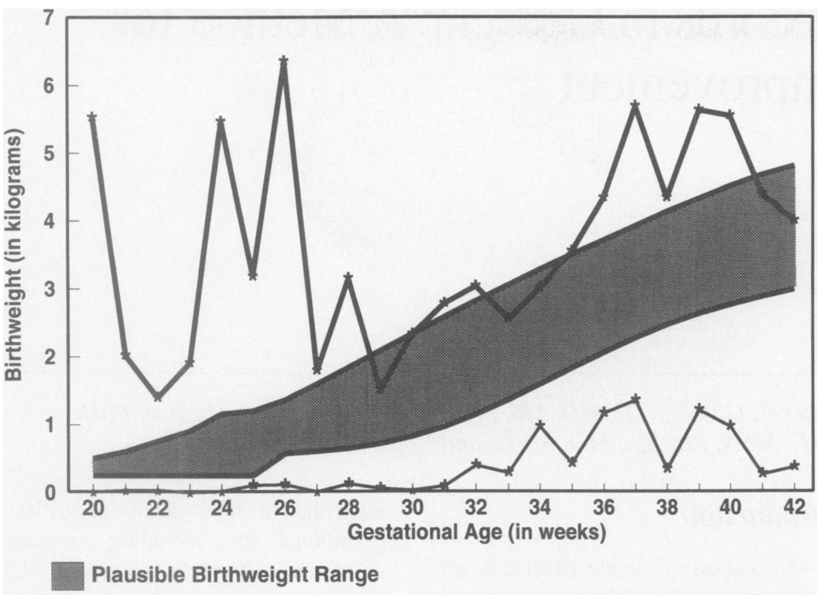

Note. Shaded ribbon represents the plausible birthweight range for White males, based on mean US birthweights that were specific to sea-level elevation, race, sex, and gestational age, ± 2 SD (range, 2.3% to 97.7%).[13]

FIGURE 1—Minimum and maximum birthweight at each gestational age for singleton fetal deaths prior to error correction: Georgia, 1989 and 1990.

pregnancy's plurality and 345 records from multiple-gestation pregnancies, because only singleton referent birthweights were available. This left 14 929 singleton fetal deaths. Next, we excluded 427 records missing both gestational age and birthweight, assuming many to be spontaneous abortions, for which data would be difficult to ascertain clinically. We also excluded an additional 12 249 records with gestational ages of less than 20 weeks and 27 records with no gestational age but weights of less than 479 g. Finally, we selected the 2226 records with gestational ages of 20 or more weeks (the reportable fetal death age recommended by the National Center for Health Statistics) or with no gestational ages and birthweights of 479 g or more (the fifth-percentile birthweight at 24 weeks' gestation for White male infants from US referent birthweights[13]).

Selecting Implausible or Problem Values

To evaluate our study population for implausible gestational age and birthweight values, we used sex-, race-, and gestational age–specific referent birthweight distributions to define criteria.[13] The plausible birthweight distributions at each gestational week from 26 to 42 weeks were developed by the probability plot method and were based on singleton sea-level birth records in the US natality files from 1980 to 1987.[13–15] We used the values plus 2 standard deviations from the mean (97.7th percentile) and minus 2 standard deviations from the mean (2.3th percentile) as the upper and lower bounds, respectively, of these distributions. Because corresponding bounds for births of 20 to 25 weeks' gestation were unavailable, we extrapolated the upper bound values from those of the referent 26- to 42-week birthweight distributions and substituted 250 g as the lower bound values. We defined biologically improbable reports as those with birthweight at or beyond the referent upper and lower bound values for the given gestational age. When sex or race was unknown, we used the referent birthweight values for White males. Also, records with reported ages of 43 weeks or more were scrutinized as "problem" records, since, with current obstetric practice, few pregnancies are allowed to continue beyond 42 weeks.

Finally, for verification, we included records with missing birthweights but with ages of 20 weeks or more and records with missing gestational ages but with birthweights of 479 g or more.

Verification of Values

To verify problem reports, one trained auditor telephoned (from July through September 1992) the delivery room staff, the medical records staff, or both, at each of the 100 reporting hospitals. Hospital staff were asked to review delivery logs, attendant notes, pathology reports, or other information to verify or obtain birthweight and gestational age. Follow-up contacts by telephone, fax, or mail preceded entry of all reported corrections into our database.

Examination of Problem Values and Effects of Corrections

We compared available characteristics of problem records with those of non-problem records to evaluate potential sources of incorrect or missing data. Chi-squared independence tests were used to test differences between proportions. To account for rounding differences between the original and verified birthweights (when given in pounds and ounces rather than in grams), only birthweight corrections of more than 10 g were considered.

Results

In age- and race-specific graphs of birthweights by gestational age, such as Figure 1, the maximum and minimum (outlier) weights, especially those at extreme gestational ages, seem implausible when compared with the referent weight ranges. After corrections, there were fewer implausible outlier weights.

Values were improbable or missing for 817 (36.7%) records (Table 1). Compared with records having plausible values, records having implausible or missing values were significantly more likely to have an unknown sex and a young gestational age. Of the 817 records, value verification was required for 42.2% of records with 20- to 25-week gestational ages and 30.9% of records with 26- to 42-week ages. Also, for 354 records (43.3%), the birthweights were below the cutoff, while for 129 (15.8%) they were above; for 326 (39.9%), data were missing; and for 8 (1.0%), gestational age was 43 weeks or more. Specific data problems were identified within different gestational age categories. For example, 52% of the 444 records for deceased fetuses delivered at 20 to 25 weeks' gestation were missing data, and 64.7% of the 351 records for those delivered at 26 to 42 weeks' gestation had birthweights below the cutoff.

Of the 817 problem records, verifying information was available for 716 (88%). The other 101 records were more likely than these to be missing birthweight or fetal sex or to have been from hospitals without obstetrical services. Gestational age, race, and birthweight were not correlated with availability of verifying information.

Overall, 405 records (56.6%) had gestational age or birthweight corrections or both. The corrections made may or may not have resulted in record reclassifications. After the corrections were made, 165 (23.0%) of the 716 reviewed records were reclassified within the expected ranges (Table 2). For 45 (27.3%) of these records, the original birthweights or gestational ages had been below the referent criteria, and for 31 (18.8%) the original values had been above the criteria. Also, of those reclassified, 88 records (53.3%) had some missing data—83 (50.3%) were missing a birthweight and 5 (3.0%) were missing an age.

We analyzed discrepancies between corrected values and originally reported values after accounting for birthweight rounding. When we compared corrected and original gestational ages, 164 (23.3%) of 704 records with implausible gestational ages were corrected (Table 3). Also, 51 fetal death records with reported gestations of 20 weeks or longer (7.2% of 704 records) were reclassified as spontaneous abortions. When we compared corrected and original birthweights, 124 (27.0%) of 460 records with implausible birthweights were corrected (Table 3). After corrections, very low weights were generally increased and high weights decreased. Finally, birthweights were obtained for 149 incomplete records (48.0%).

TABLE 1—Numbers and Percentages of Fetal Death[a] Records with Implausible or Missing Gestational Age or Birthweight, by Selected Characteristics: Georgia, 1989 and 1990

Characteristic[b]	Implausible or Missing Values (n = 817) No.	(%)	No Implausible or Missing Values (n = 1409) No.	(%)	% with Implausible or Missing Values (Overall % = 36.7)
Sex*					
Unknown	202	(24.7)	52	(3.7)	79.5
Male	349	(42.7)	732	(52.0)	32.3
Female	266	(32.6)	625	(44.4)	29.9
Gestational age, weeks*					
20–25	444	(55.3)	608	(43.2)	42.2
26–31	121	(15.1)	255	(18.1)	32.2
32–36	105	(13.1)	252	(17.9)	29.4
≥37	133	(16.6)	294	(20.9)	31.2
Maternal race					
White	332	(40.8)	584	(41.5)	36.3
Black	470	(57.8)	793	(56.3)	37.2
Hispanic or other	11	(1.4)	31	(2.2)	26.2
Married					
Yes	405	(49.9)	708	(50.4)	36.4
No	407	(50.1)	698	(49.6)	36.8
Hospital-designated level					
Level 0 (no obstetric service)	45	(5.5)	72	(5.1)	38.5
Level 1	144	(17.6)	255	(18.1)	36.1
Level 2	215	(26.3)	360	(25.6)	37.4
Level 3	209	(25.6)	322	(22.9)	39.4
State-funded level 3	204	(25.0)	400	(28.4)	33.8
Trimester entered prenatal care					
1st	385	(56.2)	695	(56.8)	35.7
2nd	135	(19.7)	253	(20.7)	34.8
3rd	17	(2.5)	51	(4.2)	25.0
No prenatal care	148	(21.6)	225	(18.4)	39.7

[a]≥20 weeks' gestation.
[b]Records with missing characteristics included 14 with no gestational age estimates, 5 with undetermined maternal race, 8 missing marital status, and 317 missing trimester entered prenatal care.
*Chi-square test for independence ($P < .001$).

Discussion

We found a substantial number of fetal death records with missing or incorrect gestational age, birthweight, or both. We successfully contacted hospitals to review data for 716 records (88%) with improbable or missing values, and we obtained much information by telephone. Also, the resources needed to review and correct records were minimal and time-limited. Most missing data were collected during the first 3 weeks after initial contact. Most hospital personnel were very cooperative, and several asked for regular feedback to prevent a "flood" of information requests later. Analyses done without these corrections, however, could have led to biased results, since problem records differed from non-problem records. Researchers who ignored records with missing values would have deleted 15% (326/2226) of the records for reportable fetal deaths in Georgia in 1989 and 1990.

Our study has several limitations. First, by reviewing problem records only, we may have underestimated the magnitude of the errors. However, selective review enabled us to focus on the records most likely to benefit from the review. While most records (3454) excluded because of unknown pregnancy plurality were spontaneous abortions, only 107 of the total 3976 records met the gestational age and birthweight criteria for singleton record review. Fewer of these 107 would have been singletons.

Second, we were unable to evaluate the accuracy of gestational ages or birthweights. The reliability of gestational age estimates depends on the accuracy of the date of last menses, practitioner expertise, the availability and timing of ultrasound, and the performance of an autopsy. Inaccurate measurements may account for some of the questionable data not corrected, particularly for extreme outliers (see Figure 1).

Third, obtaining quality hospital data depends on accurate documentation, access to medical charts, and accurate

TABLE 2—Numbers and Percentages of Fetal Death[a] Records with Implausible or Missing Gestational Age or Birthweight after Verification, by Type of Problem: Georgia, 1989 and 1990

	Before Verification					
	Implausible Values[b] (n = 449)		Missing Data[c] (n = 267)		Total (n = 716)	
After Verification	No.	(%)	No.	(%)	No.	(%)
Within criteria	77	(17.1)	88	(33.0)	165	(23.0)
Implausible values[b]	353	(78.6)	55	(20.6)	408	(57.0)
Missing data[c]	2	(0.4)	109	(40.8)	111	(15.5)
Gestation <20 weeks and birthweight reported	17	(3.8)	15	(5.6)	32	(4.5)

[a]≥20 weeks' gestation.
[b]2 SD above or below the referent population mean birthweights or gestation of 43 weeks or longer.
[c]Missing birthweight, gestational age, or both.

TABLE 3—Numbers and Percentages of Fetal Death[a] Records with Corrected Values, by Amount of Discrepancy with Original Reported Implausible Value: Georgia, 1989 and 1990

	Original Value					
	Too Low		Too High		No Change	
Amount of Discrepancy	No.	(%)	No.	(%)	No.	(%)
Gestational age[b]						
>2 weeks	25/54	(46.3)	66/110	(60.0)	...	...
≤2 weeks	29/54	(53.7)	44/110	(40.0)	...	...
Any discrepancy	54/704	(7.7)	110/704	(15.6)	540/704	(76.7)
Birthweight[c]						
≥250 g	31/67	(46.3)	18/57	(31.6)	...	...
<250 g	36/67	(53.7)	39/57	(68.4)	...	...
Any discrepancy	67/460	(14.6)	57/460	(12.4)	336/460	(73.0)

[a]≥20 weeks' gestation.
[b]No. records reviewed with nonmissing ages = 704.
[c]No. records reviewed with nonmissing weights = 460.

reporting by hospital personnel. Some data were not available, especially from hospitals without obstetric services. Some pathology or other records were unavailable for deliveries performed in emergency rooms or by nonobstetrical staff.

Fourth, some uncorrected outlier points could have been biologically plausible if physiological changes due to maternal disease, such as pregnancy-related hypertension and diabetes, were considered.[16] For example, postmortem, in utero volume loss could have occurred in a very large–for–gestational age fetus and led to a reduced weight. Also, since we used live-birth weight-for-gestational age referent values, some true problem fetal weights may not have been detected.

Finally, gestational age–specific birthweight distributions could differ between reported and unreported fetal deaths; however, we did not review hospital records for unreported deaths. Underreporting of fetal deaths, which has been described as a significant problem for states,[17–19] could lead to biased results in perinatal studies based on vital statistics. However, we believe that fetal death reporting may be better in Georgia than in other states, because registration areas requiring reporting of *all* fetal deaths have more complete reporting than states not requiring spontaneous abortion reports.[2,20]

Despite its limitations, our study's findings support the need for vital statistics data evaluations, using standards combining gestational age and birthweight. Several birth certificate data studies, not using combined standards, have shown good agreement between reported and hospital-record gestational ages and birthweights.[21,22] However, such studies can find only the most obvious problem values, such as missing or negative ages, and will miss other errors[3,11,23] that are detectable with weight–for–gestational age criteria.

Thus, an advantage of our study is our use of gestational age–specific birthweight referent values for screening that are based on large-population data (US singleton births).[13,14] Although other references have been developed,[3,24–29] they differ by populations and methods used.[29] The US referent distributions accounted for subpopulation birthweight differences (e.g., by sex), adjusted out problem secondary modes in the birthweight distributions caused by incorrect data,[3,11,13,24] and accounted for recent secular changes in birthweight distributions.[30]

Efforts to improve birthweight and gestational age information have become more pertinent in perinatal research while data quality is still questioned.[2,3,8–11] Reliable vital statistics data are needed, especially at state and local levels, to further define population-based risks for and relationships between adverse perinatal outcomes, given the limited understanding of their etiologies and the small preventive impact of enhanced obstetrical care.[2,4–6,31]

We suggest that strict quality assurance procedures at the time of data recording can improve vital statistics data more efficiently than retrospective approaches—and this should be the goal. Hospital staff must be encouraged to better ascertain and document information. Electronic data input and transfers could ease reporting and provide immediate evaluation and feedback. Vital statistics offices need to improve monitoring and editing procedures for error detection. Systematic verification, as was done here, and routine queries about problem records could be used with prospective measures. Such procedures might encourage hospitals to improve the quality of their reports and reduce underreporting. Providing timely, routine perinatal outcome summaries to reporting health professionals might stimulate better quality reporting, and such a procedure should be evaluated. Continual data review by vital statistics and hospital staffs is needed to improve the quality of fetal death data, so that in-depth analyses of these data can contribute to prevention efforts for adverse perinatal outcomes. □

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